

REMARKS

This Response is intended as a complete response to the Office Action dated February 2, 2006. In view of the following discussion, the Applicants submit that all claims are presently in condition for allowance.

CLAIM AMENDMENTS

Claims 17-18, 19, and 37-38 have been amended to correct typographical errors. Specifically, the term “sacrificial absorbing material” in claims 17-18 and 37-38 has been corrected to read “sacrificial light absorbing material.” In addition, the repeated term “comprising” on line four of claim 19 has been eliminated. The Applicants submit that these amendment were made for reasons unrelated to patentability, that no new matter has been added, and that the scope of these claims have not been changed.

CLAIM OBJECTIONS

The Examiner has objected to claims 2, 9, 20 and 27 for various formalities. Specifically, claims 2 and 20 are objected to for utilizing improper Markush language. In response, the Applicants have amended the objected to language to read, “at least one of a hydrogen-containing gas or a fluorine-rich fluorocarbon gas.” Claims 9 and 27 are objected to for containing the acronym TESAC. In response, the Applicants have amended claims 9 and 27 to spell out the term, as suggested by the Examiner.

Thus, the Applicants submits that claims 2, 9, 20 and 27 are in proper form. Accordingly, the Applicants respectfully request that the objection be withdrawn and the claims allowed.

CLAIM REJECTIONS

35 USC §102

A. Claims 1-2, 4-5, 19-20, 22-23, 28, and 30

Claims 1-2, 4-5, 19-20, 22-23, 28, and 30 stand rejected under 35 USC §102(e) as being anticipated by US Patent Application No. 2004/0132291, published July 8, 2004, to *Lee, et al.* (hereinafter *Lee ‘291*). With respect to independent claim 19, and all claims depending therefrom, the Applicants respectfully disagree. In response, the

Applicants have amended claim 1 to incorporate the limitations of dependent claim 2 and have amended claims 4 and 5 to more clearly recite aspects of the invention.

With respect to 35 USC §102, or “anticipation,” the Federal Circuit has repeatedly stated that “there is no anticipation unless all of the same elements are found in exactly the same situation and united in the same way . . . in a single prior art reference.” *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 894 (Fed. Cir., 1984); *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771, 218 U.S.P.Q. (BNA) 781, 789 (Fed. Cir. 1983).

Lee ‘291 teaches a method of fabricating dual damascene interconnections of microelectronic devices. Specifically, *Lee* ‘291 teaches etching a trench in a dielectric material defined by a photoresist pattern by an RIE process using a mixture of a main etch gas, an inert gas, and optionally at least one of O₂, N₂, and CO_x. (*Lee* ‘291, ¶ [0044]; Fig. 10.) *Lee* ‘291 further teaches to remove the photoresist material using an H-based plasma obtained from H₂, N₂/H₂, NH₃/H₂, He/H₂, or a mixture thereof. (*Id.*, ¶ [0045].) However, *Lee* ‘291 fails to identify each of the claimed elements as arranged in independent claims 1 and 19 so as to establish a *prima facie* case of anticipation.

Specifically, with respect to claim 1, as amended, the Examiner asserts that *Lee* ‘291 only anticipates the claims because *Lee* ‘291 teaches to use zero H₂ and zero CF₄. (Office Action, p. 3, ll. 22 – 23.) Thus, the Examiner admits that *Lee* ‘291 fails to teach or suggest supplying to the process chamber a process gas mixture comprising a hydrofluorocarbon gas, a nitrogen-containing gas, an oxygen-containing gas, an inert gas, and at least one of a hydrogen-containing gas or a fluorine-rich fluorocarbon gas, as recited in claim 1. Thus, *Lee* ‘291 fails to identify each of the claimed elements as arranged in independent claim 1 so as to establish a *prima facie* case of anticipation.

With respect to claim 19, *Lee* ‘291 fails to teach or suggest removing the photoresist using a process gas mixture comprising a hydrofluorocarbon gas, a nitrogen-containing gas, an oxygen-containing gas and an inert gas, as recited in claim 19. To the contrary, as noted above, *Lee* ‘291 teaches to remove the photoresist material using an H-based plasma obtained from H₂, N₂/H₂, NH₃/H₂, He/H₂, or a mixture thereof. Therefore, *Lee* ‘291 fails to teach or suggest providing a substrate comprising a photoresist material, a sacrificial light absorbing material, and a dielectric material;

supplying to the process chamber a process gas mixture comprising a hydrofluorocarbon gas, a nitrogen-containing gas, an oxygen-containing gas and an inert gas; and dissociating and ionizing the process gas mixture to remove the photoresist material and the sacrificial light absorbing material, as recited in claim 19. Thus, *Lee* '291 fails to identify each of the claimed elements as arranged in independent claim 19 so as to establish a *prima facie* case of anticipation.

Thus, the Applicants submit that independent claims 1 and 19, and claims 4-5, 20, 22-23, 28, and 30 respectively depending therefrom, are patentable over *Lee* '291. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

B. Claims 1-2, 4-5, 10-12, 14, 19-20, 22-23, 29-32, and 34

Claims 1-2, 4-5, 10-12, 14, 19-20, 22-23, 29-32, and 34 stand rejected under 35 USC §102(e) as being anticipated by US Patent Application No. 2002/0173143, published November 21, 2002, to *Lee, et al.* (hereinafter *Lee* '143). With respect to independent claim 19, and all claims depending therefrom, the Applicants respectfully disagree. As discussed above, the Applicants have amended claim 1 to incorporate the limitations of dependent claim 2 and have amended claims 4 and 5 to more clearly recite aspects of the invention.

Lee '143 teaches a method for forming metal wiring layers of semiconductor devices. Specifically, *Lee* '143 teaches forming a hardmask for a trench by etching a hard mask layer 308 (such as silicon nitride or silicon carbide), optionally covered by an organic material 314 (such as a bottom anti-reflective coating) by an RIE process using "one of oxygen (O₂) and both N₂ and H₂." The etching gas may further comprise one of a C_xF_y – based gas, a C_xH_yF_z – based gas, an inert gas (such as Ar) and a gas comprising CO or O₂. (*Lee* '143, ¶ [0054]; Fig. 15; see also ¶ [0085]; Fig. 34.) *Lee* '143 further teaches to remove the photoresist material using a typical method such as an ashing process. (*Id.*, ¶ [0055]; Fig 16; see also ¶ [0086]; Fig. 35.) However, *Lee* '143 fails to identify each of the claimed elements as arranged in independent claims 1 and 19 so as to establish a *prima facie* case of anticipation.

Specifically, with respect to claim 1, as amended, the Examiner asserts that *Lee '143* only anticipates the claims because *Lee '143* teaches to use zero H₂ and zero CF₄. (Office Action, p. 5, ll. 6 – 7.) Thus, the Examiner admits that *Lee '143* fails to teach or suggest supplying to the process chamber a process gas mixture comprising a hydrofluorocarbon gas, a nitrogen-containing gas, an oxygen-containing gas, an inert gas, and at least one of a hydrogen-containing gas or a fluorine-rich fluorocarbon gas, as recited in claim 1. Thus, *Lee '143* fails to identify each of the claimed elements as arranged in independent claim 1 so as to establish a *prima facie* case of anticipation.

With respect to claim 19, *Lee '143* fails to teach or suggest removing the photoresist using a process gas mixture comprising a hydrofluorocarbon gas, a nitrogen-containing gas, an oxygen-containing gas and an inert gas, as recited in claim 19. To the contrary, as noted above, *Lee '143* teaches to remove the photoresist material using a typical ashing process, without any further detail. Therefore, *Lee '143* fails to teach or suggest providing a substrate comprising a photoresist material, a sacrificial light absorbing material, and a dielectric material; supplying to the process chamber a process gas mixture comprising a hydrofluorocarbon gas, a nitrogen-containing gas, an oxygen-containing gas and an inert gas; and dissociating and ionizing the process gas mixture to remove the photoresist material and the sacrificial light absorbing material, as recited in claim 19. Thus, *Lee '143* does not identify each of the claimed elements as arranged in independent claim 19 so as to establish a *prima facie* case of anticipation.

Furthermore, with respect to claims 11 and 31, the Applicants have amended these claims to more clearly recite aspects of the invention. Specifically, the Applicants have amended claims 11 and 31 to recite “applying a bias power of less than 1000 watts.” Accordingly, as the Applicants agree with the Examiner’s comments that *Lee '143* teaches not to use any bias power, the Applicants submit that these claims are further allowable over the cited art.

Thus, the Applicants submit that independent claims 1 and 19, and claims 4-5, 20, 22-23, 28, and 30 respectively depending therefrom, are patentable over *Lee '143*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

35 USC §103

A. Claims 9 and 27

Claims 9 and 27 stand rejected under 35 USC §103 as being unpatentable over *Lee '143* in view of *Kennedy*. In view of the amendment to claim 1, from which claim 9 depends, the Applicants respectfully disagree. With respect to claim 27, which depends from claim 19, the Applicants respectfully disagree.

Independent claims 1 and 19, from which claims 9 and 27 respectively depend, recite limitations not taught or suggested by any permissible combination of the cited art. The patentability of claims 1 and 19 over *Lee '143* is discussed above. The Examiner cites *Kennedy* to assert that it would have been obvious to use TESAC as the sacrificial light absorbing material. However, *Kennedy* fails to teach or suggest a modification to the teachings of *Lee '143* that would yield the limitations recited in either of claims 1 or 19. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, the Applicants submit that claims 9 and 27 are patentable over *Lee '143* in view of *Kennedy*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

B. Claims 3, 6-8, 13, 15-18, 21, 24-26, 33, and 35-40

Claims 3, 6-8, 13, 15-18, 21, 24-26, 33, and 35-40 stand rejected under 35 U.S.C. §103 as being unpatentable over *Lee '143* in view of US Patent No. 6,962,879 issued November 8, 2005 to *Zhu, et al.* (hereinafter *Zhu*). In view of the amendment to claim 1, from which claims 3, 6-8, 13, and 15-18 depend, the Applicants respectfully disagree. With respect to claims 21, 24-26, 33, and 35-40, which depend from claim 19, the Applicants respectfully disagree.

Independent claims 1 and 19, from which the above-rejected claims respectively depend, recite limitations not taught or suggested by any permissible combination of the cited art. The patentability of claims 1 and 19 over *Lee '143* is discussed above. *Zhu* discloses a method of plasma etching silicon nitride with selectivity to an overlying or underlying dielectric layer. Specifically, *Zhu* teaches etching silicon nitride with an etch

gas mixture including at least one fluorocarbon (such as $C_xF_yH_z$, wherein x is at least 1, y is at least 1, and z is 0 or above) and at least one oxygen reactant, and argon and/or nitrogen, or other inert gas such as helium, neon, krypton and/or xenon. (*Zhu*, col. 6, ll. 5-37.) However, *Zhu* fails to teach or suggest a modification to the teachings of *Lee* '143 that would yield the limitations recited in either of claims 1 and 19. Therefore, a *prima facie* case of obviousness has not been established as the combination of the cited references fails to yield the limitations recited in the claims.

Thus, the Applicants submit that claims 3, 6-8, 13, 15-18, 21, 24-26, 33, and 35-40 are patentable over *Lee* '143 in view of *Zhu*. Accordingly, the Applicants respectfully request that the rejection be withdrawn and the claims allowed.

NEW CLAIMS

New claims 41-42 have been added to the application. The Applicants submit that these claims are supported by the specification and that no new matter has been added. The Applicants submit that claims 41-42 are allowable over the cited art. Accordingly, the Applicants respectfully request that the claims be entered into the application and allowed.

CONCLUSION

Thus, the Applicants submit that all claims now pending are in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issuance are earnestly solicited.

If the Examiner believes that there are any unresolved issues, it is requested that the Examiner telephone Mr. Alan Taboada at (732) 935-7100 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

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